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MISCELLANEOUS REPORT NO. 34

LARCH SAWFLY CONDITIONS IN THE LAKE STATES IN 1954

A RECONNAISSANCE SURVEY

by

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Lake States Forest Experiment Station[1]

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LARCH SAWFLY CONDITIONS IN THE LAKE STATES IN 1954

A RECONNAISSANCE SURVEY

By L. C. Beckwith, Entomologist[2]

INTRODUCTION

The widespread infestation of the larch sawfly (*Pristiphora erichsonii* (Htg.)), in progress in Minnesota since the late 1940's, continued in 1954. In general, there was a decrease in sawfly populations within the older areas of the infestation, but an increase in the total area of defoliation discernible from the air. Although light in comparison with those of Minnesota, sawfly populations increased in both Michigan and Wisconsin.

The extent and severity of the infestation in the Lake States in 1954 was determined by reconnaissance surveys similar to those made in 1953. In the northern half of Minnesota, an aerial survey was made to determine the areas of partial and complete defoliation. An intensive ground reconnaissance was also conducted in observation points established in 1951; data were taken on the amount of defoliation of individual trees, and cocoons were collected for research purposes. Because of the limited time available, only restricted ground observations were made in Michigan and Wisconsin where infestations are relatively light.

1/ Maintained by the U. S. Department of Agriculture, Forest Service, in cooperation with the University of Minnesota, St. Paul 1, Minnesota.

2/ The author expresses his appreciation to W. O. Bulger and T. T. Aamodt of the Office of the State Entomologist of Minnesota for their assistance in the aerial observations, and to pilot Arthur Gieser of the A.R.S. Aircraft and Special Equipment Center. Thanks are also due to A. T. Drooz of the Lake States Forest Experiment Station and to field aides D. P. Wallesz, Daniel Meyer, and T. C. Luche for their assistance during the ground survey.

AERIAL RECONNAISSANCE

Survey Method

The aerial reconnaissance was again made possible by close cooperation between the Office of the State Entomologist of Minnesota and the Lake States Forest Experiment Station. The Aircraft and Special Equipment Center of the USDA Agricultural Research Service provided a pilot and a 4-place high-wing monoplane. County Highway maps were used in conjunction with an operation recorder.

Information on the total acreage of the tamarack type within each county was obtained from unpublished survey data collected by the Division of Forest Economics of the Lake States Station. Only land considered to be of commercial value was included, but these acreages could be expanded to include all tamarack within the county since the percentage of tamarack within each defoliation category would not change.

A land area of approximately 15 million acres was covered by the survey during the period of August 3 - 10. Flight lines were flown in east and west directions at 12-mile intervals. Observation of a 20-chain strip (10 chains on each side of the plane) produced a 2.1 percent cruise of the area. As in 1953, three stand-condition categories were used: (1) no defoliation, (2) partial defoliation, and (3) complete defoliation. The defoliation information was transferred, using a proportional divider, from the operation recorder charts to the county maps. The acreage of tamarack within each defoliation category was determined for each county completely covered by the survey.

A map was prepared, by township and range, showing the degree of defoliation of all counties covered by the flight lines (see accompanying map). If an appreciable proportion of the tamarack in any one township fell in the partial defoliation category, the whole township was placed in that category. All adjacent townships of the same defoliation category were grouped in the final map preparation. Small "islands" of a different category were omitted in final preparation, as they would be lost in photographic reduction. Therefore, areas shown on the map as partially defoliated will also contain some tamarack in the other defoliation categories. This system of map preparation is acceptable where the finished map is not detailed but is a representation of the broad picture of defoliation.

Results

The acreage of tamarack within each defoliation category is shown by county in table 1. By far the greatest acreage occurs in the partially defoliated category. The two counties having the greatest percentage of complete defoliation are in the northwestern corner of the surveyed area; of the tamarack acreage in Lake of the Woods and Koochiching Counties, 31 and 19 percent respectively are completely defoliated. The greatest amount in the no-defoliation category occurs in the southern edge of the survey.

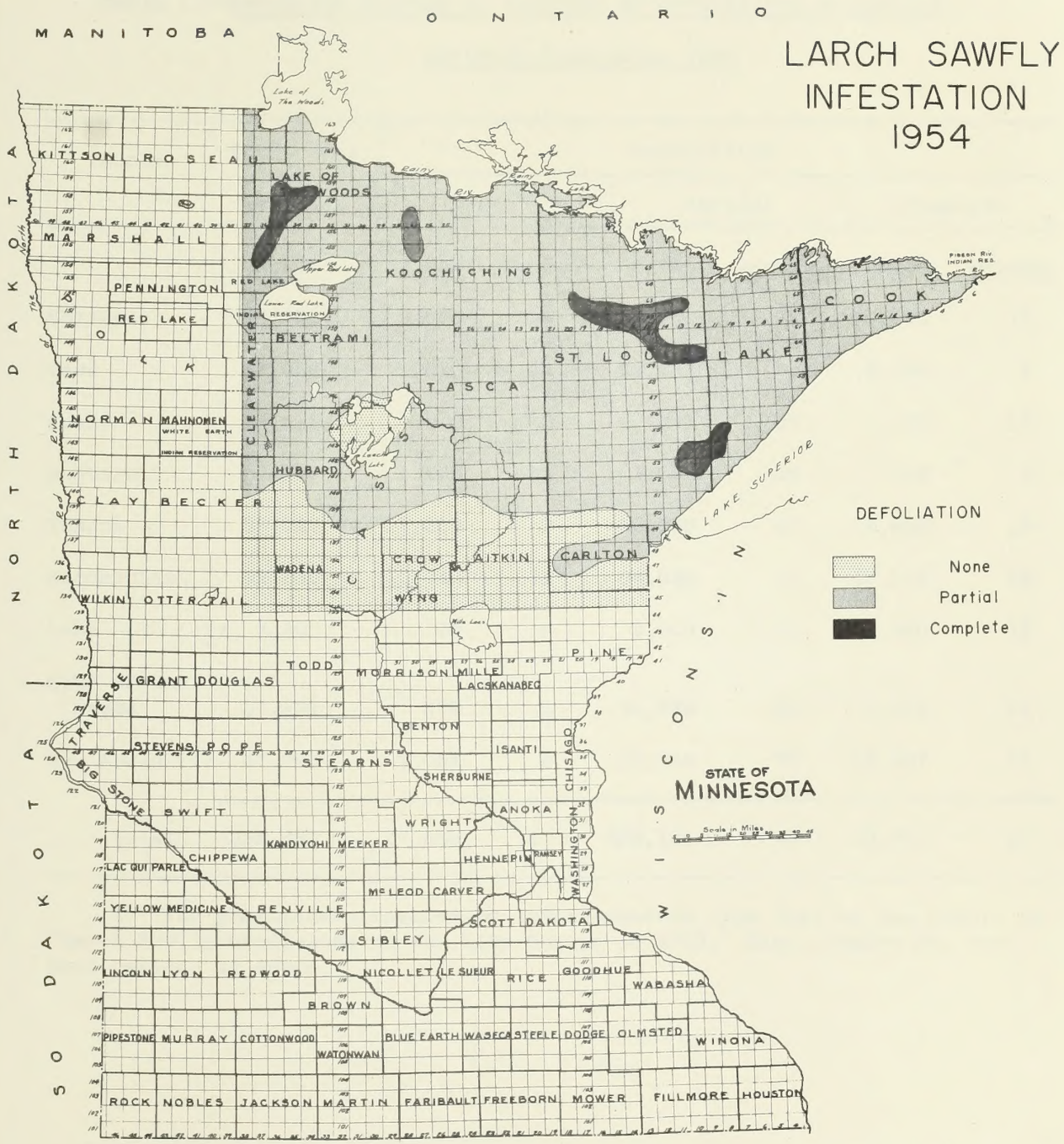
LARCH SAWFLY
INFESTATION
1954
MANITOBA
ONTARIO
NORTH DAKOTA
SOUTH DAKOTA
WISCONSIN
LAKE SUPERIOR
KITTSON
ROSEAU
LAKE OF THE WOODS
MARSHALL
PENNINGTON
RED LAKE
KOOCHICHING
BELTRAMI
CLEARWATER
ST. LOUIS
LAKE
COOK
ITASCA
NORMAN
MAHNOMEN
HUBBARD
CLAY
BECKER
CROW WING
AITKIN
CARLTON
WADENA
WILKIN
OTTER TAIL
PINE
TODD
MORRISON
MILLE LACS
KANABEC
GRANT
DOUGLAS
TRAVERSE
BENTON
STEVENS
POPE
STEARNS
ISANTI
CHISAGO
SHERBURNE
BIG STONE
SWIFT
WRIGHT
ANOKA
WASHINGTON
KANDIYOHI
MEEKER
CHIPPEWA
HENNEPIN
RAMSEY
LAC QUI PARLE
McLEOD
CARVER
YELLOW MEDICINE
RENVILLE
SCOTT
DAKOTA
SIBLEY
LINCOLN
LYON
REDWOOD
NICOLLET
LE SUEUR
RICE
GOODHUE
WABASHA
BROWN
PIPESTONE
MURRAY
COTTONWOOD
WATONWAN
BLUE EARTH
WASECA
STEELE
DODGE
OLMSTED
WINONA
ROCK
NOBLES
JACKSON
MARTIN
FARIBAULT
FREEBORN
MOWER
FILLMORE
HOUSTON
DEFOLIATION
None
Partial
Complete
STATE OF
MINNESOTA
Scale in Miles

Table 1.--Estimated acreage of tamarack by defoliation categories, northern Minnesota, 1954

County	Total area of tamarack	Defoliation					
		None		Partial		Complete	
	Acres	Acres	Percent	Acres	Percent	Acres	Percent
Beltrami	64,436	3,866	6	50,260	78	10,310	16
Cass	39,056	13,670	35	22,652	58	2,734	7
Cook	1/ 518	0	0	456	88	62	12
Hubbard	3,865	1,198	31	2,551	66	116	3
Itasca	38,649	1,159	3	32,852	85	4,638	12
Koochiching	1/ 92,180	10,140	11	64,526	70	17,514	19
Lake	1/ 2,405	96	4	2,020	84	289	12
Lake of the Woods	37,556	376	1	25,538	68	11,642	31
St. Louis	77,792	7,001	9	58,344	75	12,447	16
Total	356,457	37,506	11	259,199	73	59,752	16

1/ The preliminary figures on total tamarack area used in the report on "Larch Sawfly Conditions in the Lake States in 1953," Misc. Report 25, have been revised as above.

Only general comparisons can be drawn with previous aerial surveys, as the survey methods were somewhat different. By contrasting the 1954 map with that of the 1953[3/] survey, however, it is apparent that the acreage of complete defoliation has declined greatly. The present areas of complete defoliation occur northwest and northeast of Red Lake, in central and southeast St. Louis County, and in southwest Lake County, whereas in 1953, most of the northern half of the surveyed area suffered complete defoliation. The sawfly population in the more southern areas that were not defoliated to any great extent previously increased in 1954, thus increasing the area of partial defoliation discernible from the air. Cass County suffered 58 percent partial defoliation in 1954 as compared with 15 percent in 1953, and Hubbard County, 66 percent in 1954 versus only 21 percent in 1953. Aitkin and Carlton Counties (not included in the table because they were not completely covered by flight lines) show an increase in defoliation. It is believed that these more southern areas may suffer complete defoliation in the next few years.

The total cost of the 1954 aerial survey was $1,006.46 or approximately $0.07 for each one thousand acres of total land area. This is about $0.01 lower per one thousand acres than the 1953 survey. A comparison of the breakdown of cost follows:

	1953	1954
Salaries	$ 600.00	$ 602.00
Per diem	429.61	229.50
Plane maintenance	166.40	174.96
Total	$1,196.01	$1,006.46

It is apparent that the main difference occurred in the per diem expenditure. The reason is that the 1954 survey was finished in about one-half the time needed in 1953 because of the extremely good flying weather.

3/ Beckwith, L. C. Larch sawfly conditions in the Lake States in 1953, a reconnaissance survey. Misc. Rept. No. 25, Lake States Forest Experiment Station. Processed. Jan. 1954.

Recommendations

The aerial survey should be continued for 1 or 2 more years. This would serve two purposes: the establishment of broad population trends over at least a 5-year period, and a determination of whether areas that had suffered complete defoliation for a period of years and then only a partial defoliation for another period would again undergo complete defoliation. Ground surveys should be made in conjunction with the aerial survey to check these trends. Although suggested for elimination from the 1954 survey, Lake and Cook Counties were surveyed because the acreage involved added little to the time and expense of the survey. These counties should be included in future surveys.

The high-wing monoplane, used in 1954, has a spacious cabin which afforded excellent visibility for the observers; it has a powerful engine, which is an important safety factor in low-altitude flying and also permits a time-saving factor in ferrying from the airfield to the survey area. The county maps were used instead of the aeronautical charts because the greater detail makes them more adaptable for use with the operation recorder. The use of this instrument for recording data from a 20-chain strip is more accurate than hand-mapping a 2-mile strip as was done in 1953. It would be advisable to use the yellow plexiglas face filters, developed at the Beltsville field station, for aerial observation. They produce better contrast of ground colors and would be a distinct aid in distinguishing nondefoliated tamarack from jack pine.

GROUND RECONNAISSANCE

Method

The ground reconnaissance in 1954 followed the same pattern as previous ones in that observation points in scattered roadside areas in northern Minnesota, Wisconsin, and Michigan were examined. Defoliation estimates to the nearest 5 percent were made on ten marked sample trees and the average defoliation was computed for the area.

As in 1953, cocoons were collected at each observation point in Minnesota during both May and August. A 6-minute collection was made under each of the 10 sample trees, allowing 1 hour per observation point. The spring collection for each area was compared with the one made the previous summer to obtain the aggregate prepupal mortality. All the cocoons collected in August are presently being held at a constant temperature and humidity at the Department of Entomology, University of Minnesota. These cocoons will be dissected during February to determine the relation of the parasite and disease complex to future populations.

Results

The results of the ground reconnaissance agreed very well with those of the aerial survey (table 2). Defoliation for all the plots in Minnesota ranged from 20 to 95 percent with an average of 61 percent. When this is compared with the 71 and 84 percent that occurred in 1952 and 1953 respectively, a definite decrease in the overall defoliation is apparent. In general, the older areas of heavy defoliation show a decrease over previous years. For example, Cook County stands, which suffered heavily for the first time in 1953, had approximately the same degree of defoliation in 1954, whereas the adjacent counties of Lake and St. Louis combined, with averages of 87 and 94 percent in 1952 and 1953 respectively, showed only 66 percent in 1954. The north central part of the State averaged 54 percent, as compared with 80 percent in 1953. This is the first year since 1951, when most of the observation areas were established, that a decrease in average defoliation has occurred.

As shown by the aerial survey, the area of defoliation is increasing to the south. Ground observation points will be established in some of these areas, especially in Pine and Carlton Counties. By maintaining an increased ground observation system the population trends of the infestation can be closely followed.

Defoliation has increased in Wisconsin, but it is light in comparison with Minnesota when the state as a whole is considered. Of the four original observation points, two were dropped because they were considered inadequate for the purpose of the survey. The other two showed defoliation averaging less than 5 percent. A new observation point was established in Ashland County where defoliation averaged 50 percent, with a range of "trace" to 95 percent. In this stand, an average of 35 cocoons was collected with a range of 3 to 59. State surveys show that the heaviest defoliation occurred in Sawyer, Washburn, Douglas and Bayfield Counties. Defoliation was not uniform, in that some stands in an area were completely defoliated while others were only lightly defoliated. Plans are in preparation in cooperation with the Wisconsin Conservation Department to establish a series of observation points throughout the area north of State Highway 64 in order to follow the progress of the infestation.

In Michigan, sawfly populations have increased but defoliation was generally light. There was an increase in reports of the presence of this insect; apparently it can be found throughout the tamarack type. As in Wisconsin, the number of permanently marked observation points should be increased to follow the infestation trend. These points should be established in both the Upper Peninsula and the northern half of the Lower Peninsula, and should be maintained in cooperation with the Michigan Conservation Department.

Table 2.--Larch sawfly ground reconnaissance defoliation estimates[1/]

Sampling area	State	County	Township	Range	Section	Percent defoliation[2/] 1952	1953	1954	No. cocoons in a man-hour 1954
1	Minnesota	Roseau	163N	37W	21	10	--	--	--
1a	"	Lake of the Woods	161N	34W	35	--	70	50	38
2	"	"	159N	31W	12	95	90	65	93
3	"	Beltrami	154N	30W	9	100	--	--	--
3a	"	Koochiching	154N	25W	20	--	65	40	42
3b	"	"	157N	25W	25	--	70	35	65
4	"	Beltrami	149N	31W	29	85	80	45	188
5	"	Itasca	148N	28W	18	30	100	55	90
6	"	Cass	141N	30W	3	25	50	50	216
7	"	"	142N	28W	14	65	90	65	155
8	"	Itasca	145N	25W	13	100	95	80	262
9	"	"	147N	25W	1	100	90	60	63
10	"	St. Louis	65N	19W	29	40	95	20	33
11	"	"	62N	18W	6	80	100	65	93
12	"	"	60N	17W	22	100	95	75	123
13	"	"	59N	15W	22-23	95	95	65	45
14	"	"	60N	15W	12	95	100	95	30
15	"	"	62N	12W	8-17	70	90	60	69
16	"	Lake	55N	11W	18	100	75	60	165
17	"	"	58N	10W	32	85	95	55	69
18	"	"	60N	10W	27	100	95	65	111
19	"	"	59N	8W	27	100	100	80	48
20	"	"	59N	6W	2	90	95	85	116
21	"	Cook	62N	4W	7	40	75	70	175
22	"	"	65N	4W	24	5	55	30	44
23	"	"	63N	1E	34	25	65	70	111
23a	"	"	64N	1E	19	--	--	80	99
Average						71	84	61	102

1/ Data are given for Minnesota only. Observations in Wisconsin and Michigan were omitted because in general the plots were not considered satisfactory or were not permanently marked.

2/ Dashes (--) indicate no defoliation estimates were made as the observation points were either dropped from the survey or had not been established at that time.

No correlation was found between the number of cocoons collected and the defoliation. If a correlation actually exists, it is very difficult to establish because the ease of collection varies tremendously with existing ground conditions. These will differ even between trees within a stand as well as between stands.

Examinations for tree mortality caused by the eastern larch beetle, Dendroctonus simplex Lec., were made on the one-tenth acre plots set up within the permanent sampling areas, but none was found. These plots will be maintained to follow tree decadence over a period of years.